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Comparative Studies of Juvenile Social Behavior.

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ABSTRACT

Two studies concerning group composition were conducted using six juvenile monkeys in each study. Six juvenile Macaca fascicularis formed a stable group within the first hour of testing. Removal of the dominant male and female resulted in substantial changes in the behavior of the remaining four animals. Males became less social, while females participated in more complex social interactions. Apparently, no animal in the four animal situation was both socially adept and physically capable of assuming the dominant role. With no animal assuming the dominant role, the level of aggression was greatly increased.

In the second study, both familiarity and age of the other members of the group affected the behavior of individual animals. Familiarity and similarity in age were related to earlier play and more social interactions. The maternal behavior of juvenile males in this study casts doubts on the validity of using behavioral indicants to sex type juveniles in naturalistic observations. An interesting incidental observation was made of the appearance and apparent imitation of oral genital behavior among the male monkeys.

Behavior in a particular grouping allowed predictions of future behavior for that intact group, but did not allow predictions to an autonomous segment of the original group. An individual's behavior was dependent on the composition of the group in which he or she was participating.

INTRODUCTION

Most primates, including man, live in highly complex, year-round social groups. Due to the diversity of the roles and demands of these groups, the process of integration into groups begins almost immediately after birth. Socialization, or the linking of the individual to the ongoing society, is essential for the development of the individual, the group, and the society. An examination of the processes of socialization reveals the importance of many variables including the agents of socialization, the animal being socialized, and the contexts of the socialization.

"In order to understand the socialization process it must be viewed within the context of the social structure" (Poirier, 1972, p. 19). Because of their hierarchical dominance structure, the macaques have been the species primarily used by investigators concerned with socialization. Chance (1965) states that dominance relations in macaques are conspicuous by being consistently present and by influencing every aspect of behavior. Typically, the researcher can distinguish each animal's rank in the hierarchy except for young infants which do not interact with other animals.

Within groups, the dynamics of social behavior are revealed by identifying and contrasting the major roles animals assume. The role which has attracted most of the research is that of the leader or dominant animal. K. R. L. Hall (1968) typifies this animal as having:

(1) a priority of access to food and optimally receptive females; (2) the ability to supplant subordinates; (3) the power to prevent serious intra-troop fighting; (4) the duty of protecting the troop from predators and "aliens" of the same species; and (5) the prerogative of initiating or guiding troop movement. The power of the dominant animal depends on the composition of the group. Simonds (1965) has commented on the complex system of alliances found in most troops. Commonly, there are co-dominant leaders or a dominant consortium which control the troop.

The other major role in the troop (Bernstein and Sharpe, 1966) is that of the dominant females. They serve as the focus of group organization by means of their numerous social interactions with adult males, immature animals, and with each other. These females interact with males not only as sexual objects but also as checks on the aggression of the dominant males. Disruptive situations within the group are dealt with first by females. When the females are unsuccessful in restoring order, a male will resolve the conflict. Thus, it can be seen why adult females show more aggression than do other animals in the group. Most of the females' aggression involve threats or short chases. Seldom did a female actually physically attack another animal.

Within her complex role, the female's most important task may be the care of her infant. The primary socialization agent of the primate neonate is the mother. The development of the role of the mother depends to some extent on learning. The experience the mother

had in her infancy, her observation of other mothers' behavior, and her position in the status hierarchy all effect the behavior of the mother towards the infant. These idiosyncratic variations in learning experiences interact with genetic diversity to produce differential competencies in the skills and actual behavior of that phenomena which is commonly called mothering. For example, primiparous rhesus mothers show greater anxiety and protectiveness towards their infants than multiparous mothers do towards their infants (Seay, 1966; Mitchell & Stevens, 1967). Primiparous motherless mothers are totally ineffective in the mother role (Seay et al., 1964). None of the infants of these mothers would have survived without intervention by the E's. Maternal care by the motherless mothers, however bizarre and inadequate with their first infant, tended to change toward normative, adequate care with subsequent infants.

Likewise, infants display different behaviors depending on the mothering they received. The infants of primipara appear to be more subordinate, less assertive, less playful, and more emotionally upset than multiparous-raised infants (Mitchell et al., 1966). The infants of the motherless mothers can best be classified as hyperaggressive (Mitchell et al., 1967). Imanishi (1960) and Koford (1963) have indicated that in the Japanese macaque the infant males of high ranking mothers attain significantly higher ranking in troops than males of other mothers. Most juvenile macaque males leave the central part of the troop at puberty and live on the troop's periphery for several years. The exceptions to this rule are males of high ranking females

who always remain in the center of the troop. Young females remain in the central part of the troop even after they become adult. Their social rank follows the order of rank among their mothers.

The interactive effects of the behavioral tendencies of the mother and the infant are also important. Mitchell (1968) reports that mothers restrain females more frequently and have more physical contacts with female as compared to male infants. He attributes this to an interaction between the mother's attempting to foster independence in male infants and the male infants seeking independence.

Even though the mother has been shown to be an important agent in the infants socialization, Harlow and his associates have shown the importance of peers in comparing mother-only, peer-only, and mother-peer raised infants. Poirier (1972) interprets these studies along with clinical evidence to indicate that peer groups are "both necessary and sufficient for the development of normal adult social behavior" (p. 18).

As the infant shifts the focus of its behavior away from the mother to its peers, play develops. The onset of play in rhesus monkeys has been observed as early as the end of the first month of life (Mason, 1965). Although there is much disagreement about an exact definition of play, most observers agree as to its function in socializing the infant. In assessing socialization, Eimerl and DeVore (1965) state that "it is hardly possible to exaggerate the importance of play to an infant monkey. It seems obvious that it is through play that the infants learn to adjust to their fellows and become effective members of the society" (p. 90).

Several techniques have been developed to investigate group structure. One technique is to remove the leaders of the group--that is, the animals in the major roles. No studies have removed both the dominant male and female or just the dominant female. When the dominant male is removed, the reaction can vary from intense fighting (Washburn & Hamburg, 1968) to no report of an increase in agonistic interactions (Carpenter, 1942). Aggression depends on the sex, age, and dynamics of the group remaining after the dominant animal is removed (Bernstein, 1971). If there are several contenders or subgroups attempting to gain control, there will be many aggressive encounters. On the other hand, there may be only one animal who is immediately accepted as the dominant animal with little or no agonistic behavior.

Another strategy has been the observation of the evolution of group structure in ad hoc groups composed of unfamiliar animals. The process of integration among unfamiliar animals may elicit extreme forms of social responses (Bernstein, 1971). Two of the salient characteristics of dominance hierarchies in the laboratory are the rapid development and stability of the hierarchies. Animals form a stable structure in a matter of hours (Bernstein & Mason, 1963). In studying the dynamics of dominance interactions, Angermeir et al. (1967) found a remarkable stable pattern of triads of juvenile rhesus. Almost immediately after the three animals were released, one animal would attack another. Invariably, the attacker was the most dominant animal of the three. The animal attacked would engage the third animal

shortly afterwards and establish dominance over him. The most dominant animal was seldom observed interacting with the third ranked animal.

Angermeir et al. (1968) found that female hierarchies are not determined by the initiative of the dominant animal, but by less dominant animals actively avoiding more dominant animals. Vanderbergh (1967) reports that among free-ranging monkeys social structure may take months or years to form. In the natural environment, stages of group structure can be delineated. Females rapidly form stable groups. Adult males fight for possession of these female groups. Alliances between animals were so flexible that an animal might be found to dominate another animal one day, only to be dominated by the other animal and his cohort the next day; and, on the third day with the help of a partner dominate this pair.

The study of juvenile groups is another approach to understanding social behavior. The logic behind the use of juvenile groups postulates that the damage inflicted by these immature animals will not be lethal as it often is in adult groups (Washburn & Hamburg, 1968). Thus, with juveniles, studies lasting several days can be implemented without loss of animals due to injuries or deaths. Since juveniles are relatively inexperienced socially, they will not be as adept as adults at forming groups. The process of group formation is lengthened, allowing more time for thorough analysis of behavioral change. Also, juvenile behavior is not as ritualized as that of adults. Juveniles may thus have to produce more overt and accentuated signals to communicate information to other animals in the group. These exaggerated

behaviors, in contrast to the very subtle behaviors often used by adults, make the task of the observer less difficult. Bernstein and Draper (1964) have noted that juveniles were much more active when the adults were removed from the group. Juveniles displayed some of the characteristics of adult animals, but no animal gained the status of the full leader role. In an experiment in which the dominant male was removed from his troop, (Bernstein, 1964), an adolescent male took over the leadership of the group; even though an older, larger, sub-dominant male was present. However, this juvenile male lacked certain capabilities of the dominant male. For example, he was unable to break up intra-troop fights. Upon return of the dominant male, there was an immediate resumption of the former order.

The present studies combined certain aspects of the aforementioned strategies together with several novel components. Experiment I focused on dominance and group behavior using cross-sex and cross-age juvenile groupings. It was hypothesized that the original group's behavior would stabilize after a relatively short series of social interactions. The dominant male and female were then removed in an attempt to leave the group without its natural leader(s). Neville (1968) observed a natural rhesus troop in India which did not have any adult males. Two females assumed the leadership role. Removal of the dominant male in a labroatory or natural group may not remove the leader of the group. Since females are capable of assuming the leadership role, removal of the dominant female increases the probability of removing the natural leader of the group. After the leaderless group

was given a short period to develop a structure, the original group was reconstituted. It was hypothesized that the social structure would quickly come to resemble that which developed when the group was first formed. The second removal of the dominant animals should again change the behavior of the remaining animals.

In Experiment II, the independent variables were group familiarity and age of partners. In the first situation, there were two infants with their juvenile sibs (familiar, different age). The same two infants were paired with unfamiliar juveniles in the second situation (unfamiliar, different age). In the third situation, the four juveniles who had participated in the first two situations were used (familiar, same age). In the last situation, all six of the above animals were tested together.

The observational data included a molecular, time sampling procedure; a molar, descriptive note system; and a standardized test situation. The use of disparate observational data was intended to increase the data yield and mitigate the difficulties involved with reducing observations to numerals and expanding statistically significant numerals back to realistic interpretations.

Experiment I provided information concerning group formation in juvenile Macaca fascicularis. The primary focus of this experiment was directed toward the effects of removing and reintroducing the dominant animals in this newly formed group. Experiment II provided information concerning the influence of group composition of social behavior among

young monkeys. The specific characteristics of the group that were manipulated in this study were the age and relative familiarity of interacting animals.

EXPERIMENT I
METHOD

Subjects

Six juvenile Macaca fascicularis from the Louisiana State University primate colony were used. A capitol "F" was used to denote females; while a capitol "M" denoted males. This designation was followed by the age in months of each animal. The three females were: F44, F34, and F22. The three males were: M35, M21 and M19. M35 and F34 had been housed together with two other juveniles of approximately the same age for various periods of time between 10 months and 24 months of age. These were the only animals that had any social experience in a group containing more than one peer. Both animals had been singly housed for approximately 10 months before this experiment began. F22 and M21 had social experience together in a separation study and had been housed together up to the time of this experiment. F44 and M19 had previous social experience with peers, but each had been housed separately for at least one year before being used in this study.

Apparatus

Two living cages were placed at each end of a central living cage. Each end living cage was 27 in. long x 36 in. wide x 42 in. high. The center cage was 57 in. long x 60 in. wide x 42 in. high. The adjacent pairs of living cages were 2 in. apart and separated by

half-inch hardware cloth, which effectively prevented physical contact between animals housed next to each other. Each end living cage had an entrance to the center cage which could be opened separately by means of a sliding door. Each of the four openings was 4 in. x 5 in. However, two of the openings were reduced to 4 in. x 3 in. by a wire barrier.

Data Collection Techniques

The Boelkins' water test consisted of recording the order in which animals achieve 20 seconds of drinking from a single water bottle after 24 hours of water deprivation. Molecular behavior was recorded using a modification of the Thorne et al. (1969) system consisting of 42 behavioral categories. A list of categories and definitions is provided in Table I. A S's score for each category consisted of the number of 15. sec. intervals in which the behavior occurred within a 15 minute observation session. The range of each score was 0 to 60. A molar record consisting of brief descriptions of each animal's behavior during the testing session was recorded immediately after the termination of each session. The molar record included all periods for all subjects, whereas category system observations concerned each animal in turn for 15 minutes.

Procedure

The animals were introduced into the cage with the sliding doors closed. Two days later, the doors were opened and the Boelkins' (1967) water test was given to determine the dominance structure of the

TABLE I

BEHAVIORAL DEFINITIONS USED IN RECORDING DATA

Non-Social Behavior

Behavior directed toward an inanimate object, the observors, the self, or with uncertain orientation.

Movement - movement of at least one body length
Vocal Rattle - rattle or rumbling sound
Vocal Distress - high-pitched sounds
Vocal Coo - tonal vocalization resulting in ooo-ooh sound
Oral Manipulation - mouthing or orally exploring the cage
Oral Self Manipulation - self mouthing or exploration
Oral Water Manipulation - drinking
Oral Food Manipulation - biting food pellet
Manual Manipulation - manipulating or expoloring the cage with the hand or foot
Manual Self Manipulation - self exploration of the body with the hand or foot
Manual Food Manipulation - manipulation of food with the hand or foot
Self-Play - Bounding involving movement of three or more body lengths or two directional changes; also includes vigorous bouncing in place
Isolation - alone in the side cages or center cage for a 15 sec. period
Autoeroticism - ano-genital self manipulation
Stereotypy - three or more repetitions of a stereotyped motor behavior
Bite Self - self biting
Thrust - piston-like pelvic movements
Non-Animal Jawdrop - opening mouth in a threat
Groom Self - spreading or picking one's own fur

Social Behavior

Behavior directed toward another animal.

Non-Specific Contact - any contact with another animal
Approach - an oriented movement of at least one body length toward another animal
Withdraw - an oriented movement of at least one body length away from another animal
Non-Contact Play - Chasing or bounding at or away from another animal involving a beeline mock attack of three or more body lengths or two directional changes; also includes vigorous bouncing in place with visual orientation to another animal

TABLE I (Continued)

Social Behavior
Behavior directed toward another animal.
Contact Play - wrestling, biting with rapid changes in location, or biting with head shaking; components of play are not scored if a contact play is scored
Clasp-Pull-Cuff - clasping and then jerking another animal's fur or striking another animal
Bite - biting another animal
Jawdrop - dropping the jaw while orientated to another animal
Cling - grasping another animal's fur with one or both hands or feet
Groom - spreading or picking the fur of another animal
Imitation - repeating or imitating the behavior of another animal
Fear Grimace - retraction of the corners of the mouth in a "grin" with social orientation
Social Sexuality - ano-genital manipulation of another animal
Nursing Position - gross body contact with another animal's ventral surface
Non-Ventral Contact - gross body contact with any surface besides the ventral surface
Lipsmack - repetitive, rapid opening and closing of the mouth while oriented to another animal
Aggression - wrestling, biting and clasp-pulling with more intensity than in play; often includes pilo erection, defecation, and vocalizations
Proximity - remaining within one body length of other animal(s) for a full 15 sec. period
Delta-Thrust - piston-like pelvic movements oriented to other animal
Present - assuming typical female position while oriented toward other animal
Trail - following within one body length of another animal for a distance of 3 or more feet
Manual Other Animal Manipulation - manipulating another animal with the hand
Foot Clasp - typical male sexual posture including clinging by foot to other animal's calf

group On every observation day, each animal's behavior was recorded for 15 min. After 6 days of observation, the water test was given again. The dominant male and female were then removed. After 6 days of testing, this second group was given the water test. The original group was reconstituted and the cycle of testing was repeated. The order of testing the animals on observation days was randomly assigned. O sat approximately 1 ft. from the center cage while taking data.

Data Analysis

For each of 42 behaviors, a split-split-plot analysis of variance (Kirk, 1968, p. 308) was performed with two levels of sex, two levels of group organization, two levels of group formation, and two levels of experience with the groups. The .05 level of statistical significance was accepted for all tests.

RESULTS

The behavioral notes indicated that an organized, stable grouping was established within the first hour of testing in the six animal situation. The positive social interaction in the six animal grouping is also indicated by the significantly higher scores in the six animal versus the four animal situation for the following categories: grooming, cling, non-ventral contact, nursing position, and vocal coo. These behaviors, with the possible exception of vocal coo may be considered to be prosocial. Cooing vocalization is sometimes classified as a contact call rather than a distress call. If this view is accepted, cooing would also be classified as prosocial.

With the removal of the dominant male, M35, and the dominant female, F22, the four remaining animals became very emotional and never formed an organized group. This interpretation of the behavioral notes is supported by significant increases in the four animal situation as compared to the six animal situation of the following categories: aggression, vocal rattle, lipsmack, fear grimace, stereotypy, movement, and oral self manipulation. This pattern of scores is indicative of the stressfulness of the situation. In Table II, categories are presented which differed significantly between the six and four animal conditions without significant interactions.

An examination of the sex by condition effects (Tables III and IV) further explicates these findings. Males, in the four animal

TABLE II

MEAN SCORES FOR SIGNIFICANT CONDITION MAIN EFFECTS WHICH DID NOT HAVE SIGNIFICANT SEX X CONDITION INTERACTIONS

Behavior Category	Six Animal Condition	Four Animal Condition
Oral self	0.62	1.79
Approach	8.10	12.15
Fear grimace	1.17	3.19
Lipsmack	2.15	3.81
Vocal coo	0.71	0.00
Oral water manipulation	2.35	1.19
Cling	3.58	0.85
Nursing position	0.62	0.00
Non-ventral contact	4.62	1.79

TABLE III

MEAN SCORES FOR NON-SOCIAL CATEGORIES WITH SIGNIFICANT SEX X CONDITION EFFECTS

Sex	Males		Females	
Condition	Six animal group	Four animal group	Six animal group	Four animal group
Behavior category				
Movement	47.67	46.83	37.62	51.75
Vocal rattle	1.50	4.62	3.17	13.04
Vocal distress	1.08	0.83	0.66	2.83
Oral manipulation	6.00	10.29	5.92	3.12
Manual manipulation	4.00	10.21	6.33	3.62
Isolation	3.96	2.58	15.54	3,41
Autoeroticism	0.83	3.04	0.67	0.12
Stereotypy	0.83	0.04	1.42	9.62
Non-animal jawdrop	0.00	0.25	0.08	0.00
Groom-self	0.29	0.08	6.75	1.95

TABLE IV

MEAN SCORES FOR SOCIAL CATEGORIES WITH SIGNIFICANT SEX X CONDITION EFFECTS

Sex	Males		Females	
Condition	Six animal group	Four animal group	Six animal group	Four animal group
Behavior category				
Non-specific contact	45.92	37.04	24.96	32.46
Withdraw	15.96	13.29	5.83	16.17
Non-contact play	3.88	1.83	1.46	2.46
Contact play	12.38	1.12	0.00	0.29
Clap-pull-cuff	13.21	7.88	0.50	3.88
Bite	7.46	3.79	0.12	0.83
Jawdrop	13.91	3.75	1.33	5.79
Aggression	0.29	0.33	0.00	0.88
Proximity	1.83	1.46	5.96	1.46
Manual other animal manipulation	0.96	0.04	0.04	0.00

situation as compared to the six animal situation, increases significantly in vocal rattle, autoeroticism, and non-animal jawdrop. Decreases were observed in non-specific contact, non-contact play, clasp-pull-cuff, bite, jawdrop, and other animal manipulation. That is, males became more anxious and less social. In contrast to these changes seen in the males' behavior, the females exhibited both more general activity and more social behavior. This is indicated by the females' significant increase in movement, vocal rattle, vocal distress, stereotypy, non-specific contact, withdraw, non-contact play, clasp-pull-cuff, jawdrop and aggression. The increases in the social behaviors are interpreted as the females assuming a pattern of social activity usually found in males.

The behavioral notes allow further specification of the roles described by the quantitative results. In the six animal grouping, M35, the largest male, established himself as the dominant animal without resort to aggression. He went up to the males, jawdropped, and gave them a gentle, token bite. M35 successfully mitigated group antagonistic behavior in the six animal situation. In comparison to M35's behavior, F44, the largest and dominant animal in the four animal situation, did not show adequate behaviors for successful leadership. Instead of preventing aggression, F44 was responsible for most of the aggression seen in the four animal situation. In addition to aggression, F44 displayed several bizarre behaviors, such as biting her own back leg and poking her finger in her eye. In the six animal situation, it appeared that the males acted as inhibitors of female

aggression. This is supported by the relatively high number of jawdrops by males in the six animal group. The jawdrops, according to the behavioral notes, were mainly directed at females who were initiating aggressive encounters. In the six animal grouping, females reacted to male threats by stopping their agonistic behavior and isolating themselves in side cages. It is recalled that isolation was higher for females in the six animal grouping.

When individual scores for both six animal groups are compared to those for both four animal groups, significant differences are found for nineteen categories. In contrast, comparing the means for the first six and four animal situation with those of the second, yields significant differences for only three categories. This comparison indicates stability of individual animals' behavior in situations where the group composition was unchanged. This interpretation is based on the statistical findings which necessarily imply that the variance between six animal and four animal groups is significantly larger than the variance between groups of the same composition. The results of the Boelkins' water test offer further support for stability of groups of the same size (Tables V and VI). The Spearman rho on the last day of the first and second six animal experience, respectively, was .94 ($p < .01$). A Spearman rho of 1.0 ($p < .05$) was obtained between the rankings of four animals in the two groupings from which the dominant animals had been removed. In contrast, the coefficient of concordance (W) for the four situations involving subordinate animals was not significant. Thus, the relative rank of the four animals depended on the group composition.

TABLE V

RANK ORDER OF SIX ANIMALS IN A GROUP
FROM BOELKINS' WATER TEST

Test	After first 6 days	After second 6 days
Rank Order		
1	M35	M35
2	F22	F22
3	M19	M19
4	F44	M21
5	M21	F44
6	F34	F34

TABLE VI

RANK ORDER OF FOUR ANIMALS INVOLVED IN
FIVE BOELKINS' WATER TESTS

Test	After first 6 animal group	After first 4 animal group	After Second 6 animal group	After Second 4 animal group
Rank Order				
1	M19	F44	M19	F44
2	F44	M21	M21	M21
3	M21	M19	F44	M19
4	F34	F34	F34	F34

Upon initial group contact following individual adaptation to the apparatus, a dyadic together-together pattern (mutual clinging) was seen in four of the six animals (M21 with M19, and F34 with F22). Previous familiarity was unrelated to the choice of partners in this pair formation. Neither familiarity nor the together-together patterns seem related to the alliances that were formed. The only alliance formed, in the first 12 days of testing, was a female-male pair (F22 and M19) with the female being the more active member of the alliance. She was the initiator of the alliance as well as the more dominant animal. In the other alliance between M35 and M21, M35 was the more dominant animal, but M21 was the initiator. Both alliances occurred in the six animal situation. No alliances were observed in the four animal groupings.

DISCUSSION

When the six animals were initially placed together, M35, the oldest male, quickly established himself as the dominant male, showing all the characteristics of that role as described by Hall (1968). He had first access to food and water, controlled intra-group aggression, protected the group from the O's, and regulated the level of activity in the group. Only once did M35 seem to be an ineffective leader. On that occasion, observing F44 attacking F34 in a side cage, M35 charged at the O's, jawdropping and shaking the cage. He then paced the cage with a dominant strut and hair pilo erect. However, he did not stop F44's aggressive biting for several 15 sec. periods. M35 seldom left the center cage where most of the positive social activity of the group took place. During this study, this 3 year old male physically matured. He went through a noticeable growth spurt, his testes descended, and the O's observed vaginal plugs in the females. It appears that this male was responsible for the rapid stabilization and organization of the six animal groupings.

In contrast to the six animal groupings, the four animal situations were disorganized. The inadequate and bizarre behavior exhibited by F44, the dominant animal in the four animal situation, may have indicated an inability to assume the dominant role. Parenthetically, she was bred and produced her first infant after completion of the study and is a normal monkey mother. The pressures of group behavior

are, evidently, very different from those of maternal behavior.

Angermeir et al. (1968) stated that males establish dominance by active physical encounters. On the other hand, females establish dominance by withdrawal of the subordinate animal before actual physical interaction takes place. Contrary to Angermeir et al.'s position, in the present study it was found that females actively engage in social interactions in establishing dominance. This study differed from that of Angermeir et al. in that bisexual rather than unisexual groups were used. Another difference between the two studies was that the present study used crab-eaters instead of rhesus monkeys.

In this experiment, M35, a juvenile, demonstrated all aspects of the dominant role. However, Bernstein and Draper (1964) stated that no juvenile rhesus gained the full status of the leadership role in an eleven animal, juvenile group. The discrepancy between the studies may be explained by considering the differences in space available to the groups. Bernstein and Draper's animals were in a much larger area which allowed animals to avoid each other and remain apart from the group. Vandenburgh (1967) has shown that animals in a semi-natural environment take up to 2 years to form stable groups. The animals in this study were in a relatively small enclosure which did not permit disassociation from the group.

In this study three recording techniques were used: a molecular, time sampling procedure; a molar, descriptive note system; and a standardized test situation. The use of multiple measures of behavior helped to insure that isolated spectacular events were not taken to be

typical occurrences. The recording of molecular behaviors was necessary to make quantitative statements about behavior changes. However, the recording of molecular behaviors may sacrifice perspective. Behavior notes proved to be far superior to memory alone in reconstructing the behavior of specific animals and groups of animals. The integration of descriptive narrative, an observational category method, and a standardized test situation would appear to compensate for several difficulties seen in many observational studies.

EXPERIMENT II
METHOD

Subjects

The six Macaca fascicularis were identified using the same notation as used in the first experiment: "F" for females, "M" for males, and the number indicating the age in months at the start of the second experiment. The animals used were M38, M37, M36, M12, F37 and F12. F37 and F12 were the only females. M36 was the sibling of M12, while M37 was the sibling of F12. M38, M37, M36, and F37 had been housed together for various periods between 10 months and 24 months of age. With the exclusion of M38's and F37's participation in Experiment I, they were all singly housed in the 6 months preceeding the start of this experiment. F12 and M12 had been subjects in a mother-younger sibling- older sibling study along with their older siblings, M36 and M37. That experiment terminated when the younger animals were approximately 6 months old. For the greater portion of the time since that experiment, F12 and M12 were housed singly. Approximately one month before this experiment, they were housed together.

Apparatus

The apparatus used in Experiment I was not changed for the second experiment.

Procedure

Four groupings were each tested six times. The composition of

the groupings were as follows: Group I- two infant-juvenile sibling pairs (M36, M12, M37, and F12); Group II- two infants with unfamiliar juveniles (M12, F12, M38, and F37); Group III- four familiar juveniles (M38, M37, M36, and F37); and Group IV - all six of the above animals (M38, M37, M36, F37, M12 and F12). After every 6 days of testing, each grouping was given the Boelkins' water test.

Data Collection

The same systems and procedures as described for Experiment I were used except for the social categories in the category system. The social categories were divided into the same age versus cross age interactions.

Data Analysis

An incomplete hierarchical analysis of variance (Kirk, 1968, p. 235) with four groups, three pairs of animals and two levels of group formation was performed for each of 49 behaviors. The six animals were divided into three pairs. The infant pair consisted of F12 and M12--the two 1 year old animals. Their juvenile siblings, M37 and M36 were called the juvenile sib pair. M38 and F37 were labelled as the non-sib juvenile pair. Each pair had scores for three situations. That is each pair interacted with another pair in two situations and in the six animal grouping in the third situation. There were two levels of group formation. The first 3 days of testing was compared to the second 3 days of testing. The Duncan multiple range test was used to evaluate the within pair differences across group compositions.

RESULTS

The Boelkins' water tests given after each grouping (Table VII) indicate that no animal changed its ranking in relationship to any other animal. Therefore, all the Spearman rho's are equal to 1 with $p < .05$. The dominance hierarchy among the six animals in this experiment was as follows: M38, the dominant male; (2) M37, the second largest male and M38's main play partner; (3) F37, the oldest female; (4) M36, approximately the same age as the other juvenile males, but much smaller; (5) M12, the infant male; and (6) F12, the infant female.

The behavioral notes indicated that familiarity and similarity in age were related to lower apparent levels of emotionality, earlier play within the 6 day interaction period, and more social interactions. Familiarity influenced social behavior scores in two ways, the infants were strikingly different in their interactions with familiar (sibs) versus unfamiliar juveniles. As each animal became more familiar with a particular group, his or her behavior changed. This interpretation is supported by data comparing the first three days within a particular composition to the second three day period. That is, as the animals became more familiar with each other in the groupings, certain categories, which are considered indicators of emotionality and social behavior, changed. A reduction in emotionality is indicated both by the significant increases in manual and oral manipulation of food and the decreases in cross age lipsmack and same age fear grimace.

TABLE VII

RANK ORDER OF ANIMALS INVOLVED IN THE FOUR BOELKINS' WATER TESTS

Groupings	Familiar different age	Unfamiliar different age	Familiar same age	Six in a group
Rank Order				
1	M37	M38	M38	M38
2	M36	F37	M37	M37
3	M12	M12	F37	F37
4	F12	F12	M36	M36
5	--	--	--	M12
6	--	--	--	F12

Increases in cross age non-specific contact, cross age non-contact play, cross age clasp-pull-cuff, cross age contact play, and same age contact play are indicative of an increment in social behavior. An increase in social behavior is also interpreted as an indication of a decrease in the stressfulness or emotionality of the situation.

A further explication of these changes can be obtained by examining the significant differences across pairs and compositions (Table VIII). The five significant categories were: same age non-specific contact, same age non-contact play, same age non-ventral contact, same age lipsmack, same age fear grimace, and cross age non-specific contact. Infants significantly decreased in same age non-contact play while increasing in same age non-ventral contact when placed with non-sib juveniles rather than their siblings. From the behavioral notes it can be ascertained that the infants' behavior, during this interaction period, involved remaining away from the dominant male, M38. For the infants, same age non-contact play was significantly depressed in the six animal grouping. The behavioral notes indicate that this depression is an artifact due to the high level of cross age contact and cross age play.

For juvenile sibs, the same age non-contact play score was significantly lowered in the two situations where same age juveniles were present. Juvenile sibs significantly increased in lipsmacks and fear grimaces in their first pairing with the other juveniles. The reduction in play, according to the behavioral notes, can be attributed to the aggressive actions of F37, the dominant female. The increases in

TABLE VIII

MEAN SCORES OF CATEGORIES WITH SIGNIFICANT DIFFERENCES ACROSS PAIRS AND COMPOSITIONS

Pair	Infants	Partner Juvenile sibs	Non-sib juveniles	Entire Group
	Same age non-specific contact			
Infants		23.67	26.08	18.33
Juvenile sibs	42.17		47.67	45.17
Non-sib juveniles*	00.42	49.83		37.25
	Same age non-contact play			
Infants*		4.50	0.00	0.50
Juvenile sibs*	9.83		4.42	5.42
Non-sib juveniles*	0.50	4.08		4.33
	Same age non-vental contact			
Infants*		1.25	6.58	2.58
Juvenile sibs	0.33		0.92	1.25
Non-sib juveniles	1.67	0.17		1.17
	Same age lip-smack			
Infants		0.42	0.08	0.00
Juvenile sibs*	0.92		4.25	1.08
Non-sib juveniles*	0.83	6.17		1.67
	Same age fear grimace			
Infants		0.00	0.00	0.00
Juvenile sibs*	0.00		5.50	0.58
Non-sib juveniles	0.58	0.42		0.08
	Cross age non-specific contact			
Infants*		28.58	06.17	46.67
Juvenile sibs	25.25		-----	35.17
Non-sib juveniles	07.50	-----		28.25

*Differences across partners are significant ($p < .05$) for pairs with asterisk.

signs of emotionality, the increased lipsmacks and fear grimaces, were due not only to the aggressive actions of F37, but also to the behavior of M38, the dominant male. These emotional signs were, in part, reactions to M38's behavior in establishing himself as the dominant male.

The non-sib juveniles' social behavior was depressed in their first pairing with the infants. This interpretation is supported by a significant depression in same age non-specific contact and same age non-contact play for the juvenile sibs when placed with the infants. When paired with the juvenile sibs, the non-sib juveniles significantly increased in same age lipsmack. The behavioral notes support this indication of a high level of emotionality in the juvenile grouping.

Some peculiar sexual behavior was seen in the four situations. On the first day of testing, M36 engaged in oral manipulation of M37's genitals five times. On 5 out of the 6 days of testing in the first situation, M36 displayed this behavior. M38, M37, and M12 were also seen engaging in oral genital behavior with other males. Twice, while he was being groomed by another male, M38 ejaculated and ate his semen. M38 was also seen to masturbate to ejaculation. Both M12 and M36 orally manipulated F12's nipples.

DISCUSSION

No animal's rank in relationship to other animals changed with the alterations in group composition. However the modifications of the groups did alter the behavior of individual animals. The changes in individual behavior with the modification of group composition, demonstrated that age and familiarity affect both the range of behaviors emitted and the frequency with which they are emitted.

Most of the aggression in the groups was done by M38, the dominant male, and F37, the dominant female. F37 was the instigator of at least half of M38's aggressions. M38's other aggressive acts were against animals with whom he was trying to establish a social relationship. At M38's approach, F37 and M36 showed no signs of submission and were attacked. In his interactions with F12 and M12, it was apparent that M38 was frustrated by his unsuccessful attempts to lure the infants into play, grooming and sexual behavior.

The oral genital behavior of the males indicates that oral genital behavior is easily learned and maintained. M36 was the first animal seen showing oral genital behavior. Apparently this behavior was imitated by the other males. The repeated occurrences of this behavior indicate its reinforcing properties. It is interesting to note that this behavior did not seem to be related to the absence of females. The males mounted both of the females in addition to engaging in oral genital behavior.

Each of the older siblings served as a mother to his own younger sibling. That is, the older siblings would quiet and comfort the infants by carrying them on their ventral surfaces. This finding is relatively important to the work of primatologists doing naturalistic observations. Typically, the sex of juveniles is difficult to determine from examination of physical characteristics. Therefore, behavioral characteristics are used to sex type juveniles. The maternal behavior of the male juveniles in this experiment casts doubts on the use of behavioral measures as valid indicators of sex for juvenile monkeys.

SUMMARY

Two studies concerning group composition were conducted using six juvenile monkeys in each study. Six juvenile Macaca fascicularis formed a stable group within the first hour of testing. Removal of the dominant male and female resulted in substantial changes in the behavior of the remaining four animals. Males became less social, while females participated in more complex social interactions. Apparently, no animal in the four animal situation was both socially adept and physically capable of assuming the dominant role. With no animal assuming the dominant role, the level of aggression was greatly increased.

In the second study, both familiarity and age of the other members of the group affected the behavior of individual animals. Familiarity and similarity in age were related to earlier play and more social interactions. The maternal behavior of juvenile males in this study casts doubts on the validity of using behavioral indicants to sex type juveniles in naturalistic observations. An interesting incidental observation was made of the appearance and apparent imitation of oral genital behavior among the male monkeys.

Behavior in a particular grouping allowed predictions of future behavior for that intact group, but did not allow predictions to an autonomous segment of the original group. An individual's behavior was dependent on the composition of the group in which he or she was participating.

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